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Automate Data Collection

Automating data collection is a fundamental first step to streamlining the flow of information throughout your facility and implementing CIM. Nevertheless, the technique used, be it bar-code or voice technology, is just one piece of the puzzle. The data-collection system must also be planned to fit your company's business goals.

By Paula M. Noaker
Associate Editor

THERE'S NO QUESTION THAT BAR-CODE scanning technology is a cost-effective, flexible, and proven method for tracking inventory, work-in-process (WIP), time and attendance, and more. And it's accurate. According to one report, while keyboarding averages 20 to 30 words per minute with a 40-percent error rate, bar-code scanning technology registers the equivalent of 1,400 to 2,100 words per minute with only one error in 10 million reads. But the technology isn't infallible.

Consider the grocery store. The clerk first runs the Universal Product Code (UPC) label on your can of peaches across a scanner, automatically recording price and product type. He then repeats the procedure for another 20 items until he comes to one that won't register, even though the UPC label is intact. Technically, this is classified as a "non read", not an error.

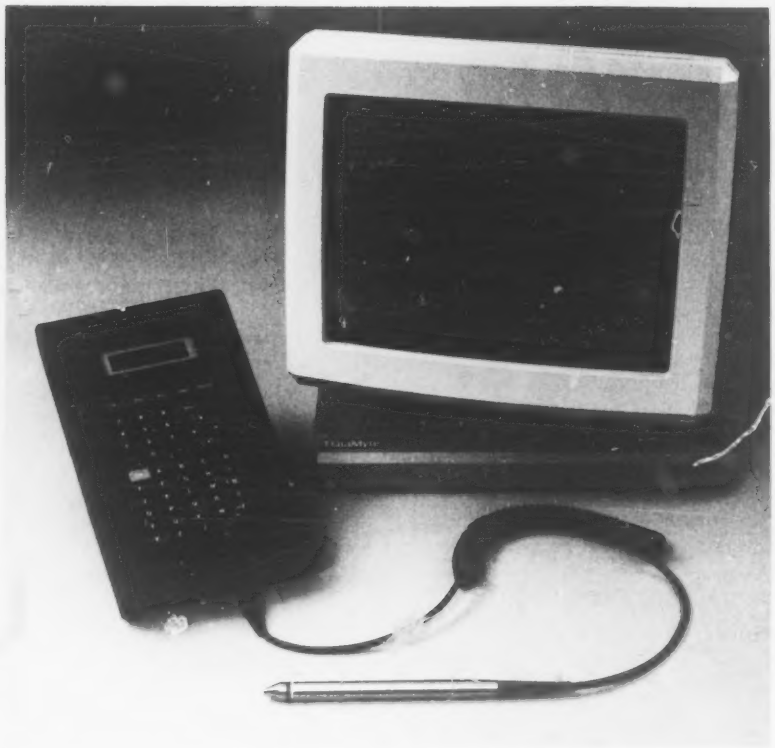
Nevertheless, while a non read barely dents productivity at the check-out counter, a similar occurrence could stop an automated manufacturing line cold. So it's not surprising that alternative automatic identification techniques such as radio-frequency identification (RFID) and voice technology are gaining a small but significant foothold in the factory—often playing a complimentary role to the bar-coding function.

A Little Push from Giants

Unlike DNC, CAD/CAM, or other well-know automation tools, automatic factory data collection (FDC) systems have been slow to catch on with discrete-parts manufacturing companies. By 1991, however, Dataquest (San Jose, CA) predicts a $560 million market for factory FDC, which represents a steady but not explosive 22.5 percent average annual growth since 1982. (Refer to "Industry Trends" charts.)

Factors that significantly affect manufacturing's buying decision include (1) the trend toward networking and integrated manufacturing systems, (2) increased functionality resulting from advances in microprocessor controls and software development, and, last but not least, (3) the need to comply with Department of Defense (DoD) and automotive industry standards.

Since publishing a symbology specification for shipping and parts identification based on the Code 39 bar-code standard, the Automotive Industry Action Group (Southfield, MI) has published five additional standards for primary metals, individual parts, containers, data identifiers, bar-code evaluation guidelines, and a vehicle identification number. According to Automatic Identification Manufacturers, Inc. (AIM; Pittsburgh, PA), as many as 35 to 40 percent of all automotive suppliers are already complying with the standards. Ultimately, up to



Manufacturing's ultimate goal should be perfect parts, perfect processes, and perfect designs, not to mention just-in-time delivery, according to Jerry Houston, Marketing Services Manager, DataMyte (Minnetonka, MN). As a result, companies are beginning to treat manufacturing as a yield-driven process; i.e., they set specific defect rates at each step. To do so, data collection must be accurate and real-time to allow management to make real-time decisions about modifying the process. (Photo courtesy of DataMyte Corp.)

29,000 companies supplying automotive will need to comply.

The Department of Defense, which is in the third revision of its LOGMARS (logistics applications of automated marking and reading symbols) bar-code standard, has targeted this year for full implementation of bar coding in shipping and receiving. The basic thrust is this: If a supplier wishes to do business with the DoD and branches of the military service, his products must carry bar-code symbols in compliance with the military specification. LOGMARS will impact about 50,000 companies.

If your company is one of almost 80,000, where do you begin? By implementing a bar-code-based FDC system? Surprisingly, most experts agree that this isn't a smart move. Implement bar-code technology to comply with standards but also keep your options open to use alternative automatic ID technologies throughout your factory-wide FDC system.

A Place to Start Planning

While automatic FDC is a must for automotive and DoD suppliers, it can also help other discrete-part manufacturers gain control of their facilities information flow. And justification can be fairly straight forward. Bob George, a senior industry analyst at Dataquest explains: "If users can increase capacity utilization with more complete information, then payback is obvious. But if users are looking for a cost savings by reducing employee head count, they will not find a payback in FDC. For FDC to be appealing, a company's goal must be to offset current costs with enhanced decision-making capabilities that allow the project to develop incrementally."

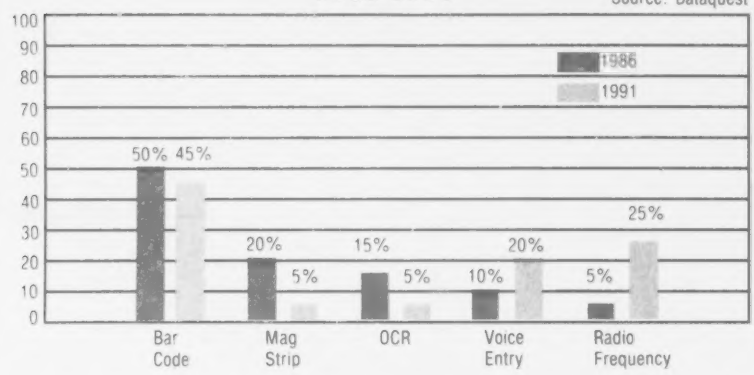
The next logical step is to focus on a need. "Once you're determined to install an automatic identification system, focus on the results desired, not on the available technologies," adds Kevin Sharp, a design engineer for Burr-Brown Quest Division (Tucson, AZ). "Prospective users are easily caught up in making sure they get the latest technology. Subsequently, they spend too little time thinking about the human factors required to make the upgrade a success.

"Pick specific goals, write down the results you want to achieve, and only then start looking for the best technical solution. Goals should be phrased in terms of what data is needed and how the data should be presented." For example:

- Identify all labor expenditures down to the minute.
- Identify all efforts of direct labor that don't contribute directly to the production of items for sale.
- Identify all workstations that produce more defects than the plant average or consistently have idle time.
- Identify all material shortages as manufacturing kits arrive.

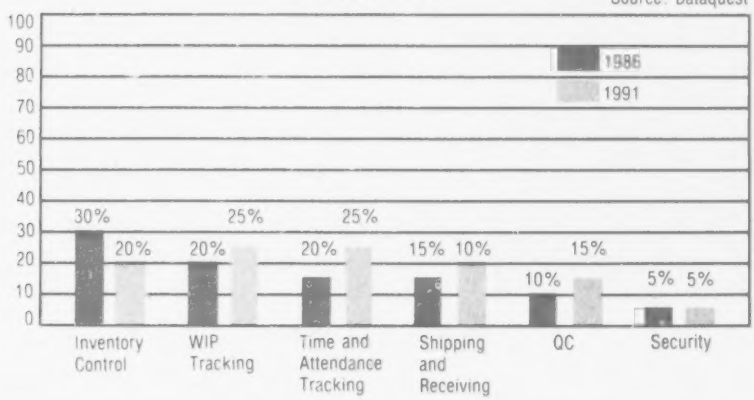
If you can't determine what type of data automates best, Michael T.

U.S. Consumption by Technology 1986-1991



While bar-code scanning technology will continue to hold the lead in the automatic identification market for factory data collection systems, voice technology and radio frequency identification will be used more often in the automation areas where bar codes won't work.

U.S. Consumption by Application 1986-1991



McEachern, supervisor of shop-floor control systems, AT&T Technologies Inc. (Oklahoma City) suggests the following selection criteria:

"A rule of thumb is that any data with a life cycle of 48 hours or less is a prime candidate for automatic data collection. Specifically, target areas involving short-term data (less than four hours) where a person makes a decision quickly and moves the product onward. Then look at areas further out."

After deciding what data needs to be acquired, the next task is to determine how to collect it. It's during this step in the FDC project that you should begin to develop an understanding of the hardware options available.

Sharp stresses, however, that you shouldn't try to design a data-collection system based on an existing paperwork system. By necessity, each piece of paper has every bit of data on it. The FDC system, however, should be designed so the computers remember all the associated information. The operators only need enter new information.

On Automatic ID Systems

A number of technologies comprise the automatic ID family. Each has the same goal of rapid, accurate data collection, but differs in its approach to capturing and processing the data. According to AIM, major options for the shop floor include:

Bar coding. Here, the symbol corresponds to combinations of digits, letters, or other punctuation symbols. Scanners "read" the codes by shining a light at the symbol and monitoring the light reflected back.

Magnetic stripe technology. Information is encoded onto a material using electromagnetic charges. A decoder then translates this information back to a computer. Because large amounts of data can be stored in a single stripe, this technology is widely used for ID badges and time and attendance systems.

Voice data entry. This technology also uses pattern recognition, but instead of images, the computer recognizes words in a pre-programmed vocabulary. The operator speaks into a microphone, the word or phrase is recognized by the machine, and information is sent to the host computer in real time. The computer can then access a file that relates to this information and send additional instructions back to the operator. Because operators train the system to recognize their voices in the environment in which they will be working, on-going background noise usually isn't a problem.

Radio frequency identification. RFID is used in automation and material-handling applications where there is no line of sight between scanner and ID ta or where read/write capability is re ired. A transponder on the object being tracked, which transmits on a specific radio frequency, sends a unique signature or a data stream in response to interrogation by the transmitter/reader. The antenna picks up the signal and the reader decodes and validates the signal for transmission to the host computer. Radio frequency technology

also plays a key role in allowing other automatic ID technologies to transmit information to a computer host via a remote radio link.

Maybe No One Answer Is Right

Although bar coding may be the solution to your problems, realize that it does have some limitations. If you are simply collecting digit information, say a string of alphanumerics, bar-code scanning is still the most cost-effective real-time data-capture method. But it doesn't provide immediate feedback from the computer system. Nor are bar-code tags or labels reusable, as with RFID tags.

So which automatic ID technology works best? That depends on the application. Take fluorescent penetrant inspection of turbine blades for example. The inspector puts the penetrant on a blade, turns out the lights, and looks for surface nicks. Voice input allows him to concentrate on the entire inspection. Otherwise, he would have to stop after each observation, turn on the lights, and jot something down.

Sometimes, two techniques compliment each other, as in the following examples.

- When capturing two different types of information. For instance, an automobile inspector uses voice input to capture characteristics of quality—a nick in the left rear quarter panel or odd color paint job. He also carries an automatic caliper to measure the gap where the door meets the frame. Both observations can be sent to the computer system in real-time via a remote radio link.
- When one technology is cost effective only in harsh or difficult environments. While RFID on the pallet may be required to track a pallet of parts through a machining cell, bar coding may be the most economical method to track individual parts once they leave that cell. In this situation, the parts would be labeled after machining.

Hence, the real productivity impact of FDC systems is felt when these data capture methods are integrated properly into a factory-wide data collection and management system. Management then has a complete information window to the manufacturing facility, not just fragments. Networking or distributed processing is the tie that binds.

Automatic Identification Techniques

	Magnetic Stripes	Bar Codes	RF Tags	Voice Recognition
Scanning Distance		Contact to 36 in.		<36 in.
Industry Standard		Yes		Not Applicable
Handheld Scanners		Yes		Yes (Radio Links)
Tag Making		Easy		Not Applicable
Tagging Reliability		Excellent		Excellent
Data Security		Good To Fair		Good To Fair

Source: Burr-Brown Corp.

To determine which automatic identification technique will work best in a given situation, six things must be evaluated: scanning stations, tag making, environmental limits, data security, reliability of tagging and network compatiblity. Ease of expansion is also important.

Networking and Integration

According to Dataquest, allowing data collection to become a function of a network provides several benefits over a dedicated system (where the data collector is hard-wired to the computer host). Since functionality resides on the network, all the downline terminals are available as data-collection devices for any application on the network. The network can be thought of as the framework for a plant-wide FDC system.

If you've ever lost important data on your office PC, you'll appreciate another network benefit—cost effective redundancy of data storage. Downtime or even loss of data at one processor will not stop the whole system.

While networked data collection systems are gaining favor with advanced FDC system users, dedicated systems are still a large percentage of sales, primarily because they meet the end user's immediate needs and are simple to implement. Unfortunately, this limits your ability to implement cost-effective, incremental FDC automation on a plant-wide basis.

Computer Hardware

Automation Research Corporation (Medfield, MA) reports that computers used for factory data collection

Comments on Data Collection

Setting up connections among devices is straightforward, as is collecting and presenting data. The real challenge is to design your FDC system to collect the "right" data and manage that data so it is available in a useable format when you need it—all without breaking the bank. Here, your best bet is to work with a CIM systems integrator that has direct experience in discrete manufacturing.—*Steven A. Kahan, Software Sales & Marketing, Northern Research & Engineering Corp. (Woburn, MA)*

Make sure your automated data-collection system can grow or change as your company's needs do. For instance, an end user can modify a voice-based data input system in about five minutes utilizing an optional user-friendly software tool.—*Kerry Lamson, General Manager, Westinghouse Voice Systems (Pittsburgh, PA)*

When planning a data collection system, don't limit that system to only the immediate application targeted. The system should be flexible enough to grow into future applications, such as inventory tracking, time and attendance, tool tracking, etc.—*Jeff Laurel, Vice President, Marketing Data Collection Systems Inc. (Minnetonka, MN)*

When I ask people that have installed FDC sytems what they would do differently the next time, most mention this: They'd involve the people who are going to be using the system earlier in the implementation project—not necessarily the cell operators, but at least the foreman.—*Bert R. Willoughby, Automation Consultant, Willoughby & Associates (Pipersville, PA)*

and management range from specialized controllers, office PCs (e.g., IBM PS/2), industrial PCs (e.g., IBM 7552), super-microcomputers, and super-minicomputers. Over the next five years, super-microcomputers will capture the largest share of the market, representing 46.1 percent of systems in use by 1993.

According to experts at Burr-Brown Quest Division, speed, data storage capability, and the type of operator interface will govern the selection of the right computer for your FDC task. In general, computers are required to perform three functions in an identification system: To acquire, to manipulate, and to store data. Each task puts stress on different components of the system; e.g., acquiring and manipulating data tax the computer's processor, while storage of large amounts of data may require a more powerful disk drive than comes with the typical PC.

The computer vendor is the best source of specific data about the processing capability of a particular machine. Sometimes, however, it helps to put your FDC information requirements into a usable format; e.g., I need to be able to store 100,000 transactions or data records of 20 characters each in case my mainframe goes off-line for a day.

Software

Once the data is collected, typical uses include reporting of material, labor, and machinery status; quality control including SPC; and maintenance tracking. While there is a variety of off-the-shelf data-collection software packages, more vendor support for application software development is needed.

The more specific your FDC application is, the harder it will be to buy ready-made software. Nevertheless, while some software customization will be required, this doesn't necessarily mean your software engineers will have to write programs from scratch. Often, off-the-shelf software provides an excellent base from which to tailor your application.

More vendors are also offering software tools to facilitate system configuration; e.g., leading data-collection terminal suppliers now provide terminal configuration software and basic software interfaces for several MRP software packages. In addition, computer companies that sell MRP software—IBM, NCR, and Honeywell, to name a few—are providing data-collection packages that include their own bar-code/badge reader terminals.

The Team Approach

For a brief recap, four types of technologies intertwine to produce a factory data collection system: automatic identification technology; computer hardware; computer software; and networking technologies. The odds are slim that any one person in your company is an expert on all. So, as with other automation projects, it only makes sense to use a team approach—from manufacturing management to the MIS department to the shop-floor foreman—when planning an FDC automation project. P

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